



Chemistry Research Academy Summer 2022

Program Director/Instructor:

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Lead Instructor:

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Course Format: Course time will be split approximately evenly between the classroom and the laboratory. Classroom activities will include guest lectures from leading faculty in the department, library research, large- and small-group discussion, and collaborative activities dealing with the background material related to the topics being presented. Laboratory activities will include instruction on the use of various instruments and learning and practice of specific research skills within the presented topics. Students will also have the opportunity to visit research labs and facilities in the department, and elsewhere on campus.

Academy Schedule:

Monday, July 11 – Friday, July 29

DAILY CLASSES

Monday – Friday

8:30 am – 3:30* pm

1-hour Lunch Break

LOCATIONS

- Classroom = (To be announced)
- Lab Area: General Chemistry Labs (Chem '58 Bldg)

PROPER ATTIRE

Students must wear or bring lab-appropriate clothing (long pants, closed-toe shoes, sleeves) every day

**Class time ends at 3:30pm, but labs may run a bit later for some groups.*

Course Syllabus:

The table on the following page provides a general outline of what will be accomplished throughout the 3-week program (though not necessarily in the order provided). There will also be research lectures and tours of some labs and facilities.

Topics & Activities

Focus Questions throughout program

- What is "Research"?
- Do real scientists use the same scientific methods as you learn in high school?
- How do you find a topic that you want to research?
- What is the role of scientific literature in research?
- What types of instruments are used in chemistry research?
- What are some areas of current research in chemistry?
- How is a scientific experiment designed?
- How much can you trust experimental results?

Program-long Research Project

- Details will be given in class. In this activity, you will design a plan for doing an independent research or science fair project for after you leave the program.

Background and introductory topics

1. Review and instruction of fundamental chemistry topics:
 - a. Atomic Structure and Periodic Table
 - b. Bonding: Structure and Properties
 - c. Chemical Reaction Dynamics
2. Introduction to department computing including networking, software, security, etc.
3. Laboratory safety procedural outlines for working in a chemistry lab
4. Library research in chemistry using Penn's vast resources

Chemistry topics related to departmental research

Broadly, we will explore:

- how we know what we know about substances and reactions
- how scientists research things they cannot see
- how structures of substances lead to unique properties and functions

Specific topics of focus are:

- Analytical techniques:
 - Spectroscopy
 - Polarimetry
 - Chromatography (various types)
- Nanoparticles – synthesis, characterization and current/expected applications
- Transition metal chemistry: coordination complexes and the role they play in many areas of research
- Organic chemistry: chirality, effects of intermolecular forces, chemistry in biology